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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/605,041
Filing Date	September 3, 2003
First Named Inventor	McCULLOUGH, Kevin A.
Art Unit	1775
Examiner Name	SAVAGE, Jason L.
Attorney Docket Number	C001 P00404-US2
Total Number of Pages in This Submission	18

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
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- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ____________
- [ ] After Allowance communication to Technology Center (TC)
- [x] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
- [ ] Proprietary Information
- [ ] Status Letter
- [ ] Other Enclosure(s) (please identify below):

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Mark E. Tetreault Barlow, Josephs & Holmes, Ltd.
Signature	Mark E. Tetreault
Date	8/12/04

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Typed or printed name	Mark E. Tetreault	Via fax (703) 872-9306 - 18 pages total
Signature	Mark E. Tetreault	Date 8/12/04

PTO/SB/17 (10-03)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

☑ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 165.00

Complete if Known	
Application Number	10/605,041
Filing Date	September 03, 2003
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METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☑ Deposit Account:

Deposit Account Number: 02-0900

Deposit Account Name: Barlow, Josephs & Holmes

The Director is authorized to: (check all that apply)

☑ Charge fee(s) indicated below ☑ Credit any overpayments

☑ Charge any additional fee(s) or any underpayment of fee(s)

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to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	

SUBTOTAL (1) ($)

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

		Extra Claims		Fee from below		Fee Paid
Total Claims		-20** =		X		=
Independent Claims		-3** =		X		=
Multiple Dependent						=

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($)

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	$165.00
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive - unavoidable	
1453	1,330	2453	665	Petition to revive - unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify)

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 165.00

SUBMITTED BY

(Complete (if applicable))

Name (Print/Type)	Mark E. Tetreault	Registration No. (Attorney/Agent)	48,289	Telephone	401 273-4446
Signature	Mark E. Tetreault			Date	8/12/04

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Serial No. 10/605,041

PATENT
ART UNIT 1775
Serial No: 10/605,041

CERTIFICATE OF FACSIMILE TRANSMISSION

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(Signature)

Mark E. Tetreault
(Printed Name)

Date: August ~~11~~ 12 2004 Pages: 16

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	McCULLOUGH, Kevin A.	)
Serial No:	10/605,041	)
Filed:	September 3, 2003	)
Title:	METHOD OF FORMING A THERMALLY CONDUCTIVE ARTICLE USING METAL INJECTION MOLDING	)
Docket No:	C001 P00404-US2	)
Examiner:	SAVAGE, Jason L.	)
Art Unit:	1775	)

APPELLANT'S BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

REAL PARTIES IN INTEREST

The real party in interest is Cool Options, Inc., of Warwick, Rhode Island, sole owner of 100% interest in the present application by way of assignment.

Serial No. 10/605,041

RELATED APPEALS AND INTERFERENCES

There are no related or co-pending appeals or interferences related to the appeal of this application.

STATUS OF CLAIMS

Claims 1-20 are currently pending. Claims 1-20 stand as finally rejected. Claims 1-20 are being appealed.

STATUS OF AMENDMENTS

No amendments were filed after the Final Rejection. The claims stand as presented under the Final Rejection.

SUMMARY OF THE INVENTION

The present invention relates generally to an improved thermally conductive composite material that is easily moldable or castable.

It is widely known in the prior art that simply improving the overall geometry of a heat-dissipating article to provide a shape that is particularly matched to the geometry from which heat is to be dissipated can greatly enhance the overall performance of the article. This holds true even if all other aspects of the article such as the base material used in the article remains the same. Since the most highly conductive material that is well suited for heat sinks is typically metal, bulk metal such as aluminum is typically machined to provide the desired heat sink geometry. However, this machining process is time consuming, expensive and puts undesirable constraints on the possible geometries available for a machined heat sink. Accordingly, the need for improved heat sink geometries necessitated an alternative to the machining of bulk metallic materials.

To meet this need, attempts have been made in the prior art to provide molded compositions that include conductive filler material therein to provide the necessary thermal conductivity. The ability to mold a conductive composite enabled the design of more complex part geometries to realize improved performance of the part. Generally the attempts in the prior art included the employment of a polymer base matrix loaded with a thermally conductive filler material. Alternately, attempts have been made using Metal Injection Molding Material (MIM) or die-casting. These attempts are, indeed, formable into complex geometries but still do not approach the desired performance levels found in metallic machined parts. In particular, because of the nature of the voids formed in an MIM or die-casting process, these parts have a lower thermal conductivity than similarly shaped heat sinks machined from solid metal. In

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addition, known conductive plastic composite materials are undesirable because they are typically very expensive to manufacture as they employ very expensive filler materials. Still further, these conductive composite materials must be molded with extreme precision due to concerns of filler alignment during the molding process. Even with precision molding and design, inherent problems of fluid turbulence, collisions with the mold due to complex product geometries make it impossible to position the filler ideally thus causing the composition to perform far less than desirable.

The present invention expands upon the concepts and advantages of prior art thermally conductive polymer compositions. The method disclosed in the present application enables a highly thermally conductive composite material to be manufactured at relatively low cost. The thermally conductive composition includes a Metal Injection Molding Material (MIM) base matrix of, by volume, between 30 and 60 percent. The base matrix is preferably aluminum but may be other metal materials. A first thermally conductive filler having a relatively high aspect ratio is provided at a volume, between 25 and 60 percent and is uniformly dispersed throughout the composition. In addition, a second low aspect ratio thermally conductive filler may also be provided to bridge any breaks in continuity and conductivity paths of the high aspect ratio filler.

During the molding process utilizing the composition of the present invention, the mixture is introduced into a mold cavity and flows into the various part geometries. The high aspect ratio filler generally aligns with the flow of the mixture in the mold and provides enhanced pathways for thermal conductivity through the already thermally conductive metallic part. By carefully controlling the flow of the injection material through the mold, the part will have enhanced thermal conductivity in the pathways created by the filler material. In addition, the filler material will increase the bulk heat transfer properties of the overall part geometry as well. In an alternative embodiment a low aspect ratio filler is also added to the injection mixture to fill the voids between the high aspect ratio filler in the mixture. As a result, the number of interfaces and base matrix thickness between filler members is greatly reduced thus resulting in thermal conductivity and performance superior to that found in prior art thermally composite materials.

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ISSUES ON APPEAL

The following issue is presented for review in this appeal:

Whether claims 1-20 were properly rejected under 35 USC §103(a) as being unpatentable over US Patent No. 5,249,620 (Guerriero) or over US Patent No. 5,249,620 (Guerriero) in view of US Patent No. 5,981,085 (Ninomiya).

GROUPING OF CLAIMS

Claims 1-10 are grouped together. Claims 2-10 stand or fall with claim 1.
Claims 11-20 are grouped together. Claims 12-20 stand or fall with claim 11.

ARGUMENT

A. Rejection of Claims - US Patent No. 5,249,620 (Guerriero)

Claims 1-20 were rejected under 35 USC 103(a) as being unpatentable over US Patent No. 5,249,620 (Guerriero). The Examiner has stated that Guerriero teaches a molding composition for producing composite materials that utilizes a metal matrix such as Al, Mg or Cu, a first thermally conductive filler such as metal fibers, ceramic whiskers or metal powders, and a second thermally conductive filler such as boron nitride, alumina or carbon and further discloses all of the other aspects of the present invention in ranges that cover the loading limits disclosed in the present invention.

The Examiner directs the Applicant to Column 3, Liens 22-50 for support of the above assertions. The Applicant has included portions of this passage below for convenience.

The present Applicant found now a process by infiltration which overcomes the hindrances determined by the infiltration processes known from the prior art.

The process according to the present invention for producing composite materials with a metal matrix and with a content of reinforcer agent lower than its minimum theoretical compaction value, with said process being based on an infiltration technique, essentially consisting in charging

the reinforcer material to a casting mould, and then infiltrating into the same casting mould the metal matrix in the molten state, with said metal matrix being then let cool until it solidifies, is characterized in that the reinforcer agent is mixed, before being charged to said casting mould, with a diluting agent having a different compaction degree.

The metal matrices of said composite materials are selected from among Pb, Zn, Al, Mg, Cu, Sn, In, Ag, Au or their alloys.

The reinforcer agent is constituted by non-metal powders.

The diluting agent is selected from among metal fibres and/or ceramic fibres and/or ceramic whiskers and/or metal powders of the same composition as of the matrix.

As ceramic fibres, the following fibres can be used:

Al.sub.2 O.sub.3, SiC, C, BN, SiO.sub.2, glass;

As ceramic whiskers, the following can be used:

SiC, Si.sub.3 N.sub.4, B.sub.4 C, Al.sub.2 O.sub.3 ;

As non-metal powders, the following can be used:

SiC, BN, Si.sub.3 N.sub.4, B.sub.4 C, SiO.sub.2, Al.sub.2 O.sub.3, glass, graphite.

As metal fibres, the following can be used:

Be, W, W coated with SiC, W coated with B.sub.4 C, steel.

The Examiner simply looked at the list of various materials provided in the disclosure as a menu to pick and choose the disclosure which he needed to support his rejection. The list of materials was taken entirely out of the context of the balance of the cited disclosure and simply plugged into the method disclosed in the present application in a clear and unequivocal exercise of hindsight reconstruction.

The disclosure in Guerriero, as taken in the actual context of the patent, teaches a two-step process where a metal matrix material (typically a metal powder) is mixed with an anti-compaction material to facilitate the reduction in metal matrix material needed to create the finished part. In the disclosure, it is clear that a reinforcing material is placed into a mold cavity. The reinforcing material may or may not include a dilution agent. After this material is placed into a mold cavity, a metal matrix is infiltrated around the mixture.

If the Examiner had read the very next paragraph of the disclosure, it is clearly disclosed that a porous material is first formed from the reinforcing powder (and possible the dilution agent)

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to create a distinct structure that is then placed into the mold which subsequently receives the metal matrix material via an infiltration process. See Column 3, Lines 55-60 reproduced below:

> *The blending of the reinforcer agent and of the diluting agent is carried out in such a way as to obtain green **premoulded pieces which are then charged** to the casting mould. (emphasis added)*

It is clear from the Guerriero disclosure that there is a coating process first that creates pellets that are placed into a cavity mold around which a MIM matrix material is placed. Then the entire composition is subjected to pressure for sintering. The filler serves to hold the matrix in an uncompacted state to create voids within the structure, reducing the weight of metal material required to form the part. Further, the anti-compaction filler is only disclosed as being a single material coated over the MIM matrix.

This disclosure is in direct contrast to the present invention where a molding compound is formed by mixing a metallic matrix, a first filler and a second filler into a uniform composition that is then subjected to a molding process. In the present invention, a composition is formed where the material is mixed into a homogenous distribution before the net shape molding process and the fillers are selected to reduce thermal interface gaps within the composition. It is clear in Guerriero that the goal is to increase the voids in the initially formed structure to allow the later infiltration of the metallic matrix.

The processes are entirely different and result in entirely different end structures having very different material properties.

The Guerriero composition is a process directed to forming a porous metallic structure having microscopic voids throughout with a reinforcing material incorporated therein to enhance the various mechanical properties of the composition, see Column 1, Lines 25-64:

> *In case of metal-matrix composites, endowed with structural characteristics, the relative roles played by the matrix and by the reinforcer phase are the following:*
>
> *the reinforcer agent has high values of strength and hardness, and the matrix transfers to it the stresses it is submitted to;*
>
> *the matrix has good inherent characteristics (physical characteristics, chemical*

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characteristics, and so forth), and the reinforcer agent serves to endow the material with particularly good mechanical properties.

Some properties of the composites can be computed with exactness by predetermining the volumetric percentages and the characteristics of their component phases; other properties can be computed on approximate models; and other properties can be forecast with difficulty, such as, e.g., fracture strength, which, although is easy determined, is always difficult to be estimated in advance.

The composites can be anisotropic; for example, a composite reinforced with long fibres shows a much higher strength in the direction parallel to the fibres, than in the transversal direction thereof; therefore, the designer will take this matter of fact into due account in order to secure a high strength in the desired direction.

Inasmuch as the reinforcer agent is used in order to improve the mechanical properties of a given matrix, it should be endowed with well determined requisites, such as, e.g., high values of mechanical strength and of elastic modulus.

These reinforcer materials are in the form of long-fibre or short-fibre filaments, or in the form of powders; for example, whiskers are monocrystalline filaments of a few microns of diameter and of some hundreds of microns of Length, endowed with high mechanical properties; they make it possible composites with high characteristics to be obtained. Unfortunately, their costs are still now too high. Silicon carbide whiskers are among those with highest values of tensile strength and of elastic modulus.

While the Examiner goes to great length to state that the reinforcer and dilution agents are first and second thermally conductive fillers, the Applicant is at a loss to find support for this assertion within the disclosure cited. The passage above speaks at great length about the various material properties that will be enhanced under the process disclosed in Guerriero but does not once mention that the one of the enhanced properties is the thermal conductivity of the material. This is mainly because the method disclosed would actually result in a reduction of the thermal conductivity of the overall composition by greatly increasing the voids found within the composition introducing countless thermal transfer gaps throughout the entire finished part. Further, the method results in reducing the overall mass of the finished part and further destroys its ability to transfer heat efficiently.

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The Examiner further states in rejecting the present invention that it would have been obvious to vary the loading rates of each component in order to optimize the strength and hardness exhibited by the composite. The Applicant concedes that this is likely to be true, however inapplicable this fact may be to the present invention. The Examiner has clearly indicated that the material properties of interest in Guerriero are those of strength and hardness, both factors of no consequence in the present application. The present application is concerned with reducing the voids and thermal transfer gaps throughout the composite material to enhance the ***thermal conductivity*** of the finished part not the strength and hardness.

It is entirely clear that the process of the present invention is directed at first mixing a loading of first and second thermally conductive fillers uniformly throughout a MIM matrix material to achieve a uniformly mixed and homogeneous molding composition and second injecting that composition into a mold cavity to form a net shape molded article having greatly enhanced thermal conductivity. In contrast, Guerriero is directed at mixing only a reinforce and a dilution agent, placing that material into a mold cavity first, infiltrating a MIM matrix around the material in the cavity thereby reducing the overall MIM material necessary to fill the mold in order to produce a MIM part that is porous with increased instances of voids throughout.

It is absolutely clear that these two processes are entirely different. While the list of raw materials may be the same, the process (which is what the claims of the present invention are directed to) in each of the disclosures is entirely diverse. The Examiner's argument is that since the formation of silicon wafers and glass bottles both start with the raw material silicon dioxide, then the process of forming the silicon wafers must be obvious in view of the process used to form the glass bottle. The reality is that even though many manufactured items utilize the same raw materials, the processes utilized to fashion those raw materials into finished goods may be quite diverse and tailored to serve the end result. This is the case when comparing the present application with the disclosure in Guerriero. The only way that the Examiner can impute that the Guerriero reference renders the present invention obvious us through an exercise of impermissible hindsight reconstruction, wherein the Examiner knowing the desired result of the present application, simply stated that all of the necessary modifications to the cited disclosure would have been obvious without providing supporting disclosure.

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Because it would not have been obvious to use the teaching in the Guerriero reference to arrive at the method as disclosed in the claims of the present invention, the Applicant respectfully asserts that this rejection cannot be maintained.

B. Rejection of Claims - US Patent No. 5,249,620 (Guerriero) in view of US Patent No. 5,981,085 (Ninomiya)

Claims 1-20 were rejected under 35 USC 103(a) as being unpatentable over US Patent No. 5,249,620 (Guerriero) in view of US Patent No. 5,981,085 (Ninomiya). The Examiner has stated that Guerriero teaches all of the aspects of the present invention but does not include teaching that discloses a first thermally conductive filler at a percentage of between 25-60%, but that Ninomiya teaches a metal matrix material using a preform filler in the required ratio and that the present invention would be obvious in view of a combination of these references. The Examiner in his response to the Applicant's arguments has stated that the only reason for which the Ninomiya reference has been cited is to provide disclosure relative to high loadings of fiber reinforcing materials.

The thrust of the Ninomiya disclosure is directed to forming an object that has enhanced dimensional stability and increased strength to resist ***surface*** peeling. As expected, therefore, the fiber loading is concentrated at the ***surface*** of the composition and this material property is the basis of the entire disclosure. In the context of the Ninomiya disclosure, it is clear that layer 2 does not show anything more than the layed up preform of reinforcing fiber as continually described throughout the disclosure. The fiber is shown in an isolated and concentrated layer near the surface because this is critical to the operation of the overall device. There is absolutely no disclosure within the cited reference that supports the Examiner's contention that Ninomiya teaches a uniform distribution of thermally conductive fillers throughout the entire composition at a loading rate of between 25-60%. The only teaching relative to this loading is directed to the provision of a preform reinforcing layer that achieves the stated concentrations only in localized regions of the finished part. In this manner, the reinforcing enhances the part's resistance to peeling when subjected to high thermal stress. Similarly, the disclosure states that in order to

enhance the thermal expansion properties of the device and limit the overall growth of the part under extreme heat, the fiber ***must*** be concentrated at the surface of the part as shown in layer 2. Further, the fiber cannot be distributed throughout the part in a uniform manner due to the limitations found within the disclosure itself. Since a preform is used, when the part is cavity molded the preform, layed up fiber is maintained in the same relative location within the part as where it was placed in the lay up process.

In contrast, it would be obvious to one skilled in the art that the disclosure provided by the Applicant in the present invention and in particular in Fig 4 of the present application in fact weakens the overall structure and detracts from highly stable part geometries due to the dissimilarities in the adjacent materials throughout the base matrix material. The interfaces between each of the reinforcing fibers are actually reduced if not eliminated, causing voids in the structure of the surrounding matrix and resulting in a weakening of the overall matrix. The claims of the present invention are directed at providing the disclosed load ratios in a homogeneous distribution throughout the entire composition.

Further, regarding Claims 15, 19 and 20, Ninomiya does not teach the use of two filler materials, one of which includes ceramics in any way. While the reference does disclose the possibility of incorporating a ceramic reinforcing filler, it does not describe the selection of a ceramic as one of two fillers that are carefully selected to operate in conjunction. Further, there is no disclosure relative to uniform dispersement of the filler within the matrix. Finally, there is no support in this disclosure describing the use of two different thermally conductive fillers having a different shape and/or a different aspect ratio.

In fact, the varied shaped of the filler material in the disclosure of the present invention provides for particular characteristics that can be tailored to the base matrix material being used to further enhance the overall thermal conductivity of the composition. In particular, the various shapes are particularly suited to nest with the crystalline structure of the base matrix material to reduce the interface gaps for improved thermal transfer in the overall composition. This is clearly shown in Fig. 4 of the present application. Therefore, selection of the various shapes of filler is not simply a design choice but an important feature of the invention. As is shown in Fig. 4, the varied filler shapes nest together to reduce interface gaps and enhance the thermal conductivity. There are clearly unexpected results in that the particular shape of the fillers selected and the

particular loading ratios cooperate to form a composition wherein the fillers nest within each other to reduce the number of thermal gaps and interfaces within the overall composition as described in the claims.

In reviewing the Ninomiya reference, there simply is no mixing, there is no uniform distribution, there is no enhancement of thermal conductivity throughout the entire part, and there is no reduction in overall thermal interface gaps within the composition. In short, there is no disclosure within Ninomiya that describes any of these aspects of the present invention.

Further, if Ninomiya were combined with Guerriero a process wherein a porous metal matrix was formed around a preform reinforcing element would be disclosed. It is impossible for the combination of the Ninomiya and Guerriero references to provide sufficient disclosure to enable a person skilled in the art to arrive at the present invention. Since the references cited by the Examiner teach away from the disclosure in the present invention and because the cited references do not either alone or in combination teach the claim limitations of the method of the present invention, the Applicant asserts that it would not have been obvious to a person skilled in the art in view of the cited references to arrive at the present invention.

While clearly one could assemble virtually any known device from a combination of prior devices by simply picking and choosing the appropriate constituent elements from prior art references, the standard of law requires that the references provide some basic teaching or suggestion that would motivate the combination. There is simply nothing explicit or implicit in Guerriero or Ninomiya that would motivate someone skilled in the art to simply utilize the loading ratio disclosed in Ninomiya separate and apart from the portion of the disclosure relative to the reinforcing material being localized in a preform element in combination with the MIM matrix in Guerriero. Additionally, the use of a preform reinforcing material would not result in a reduction in the voids distributed throughout the finished part as is desired and emphasized in the Guerriero reference. It is clear that no one skilled in the art would be motivated to combine the two references cited by the Examiner without first having knowledge of the Appellant's intended device. The combination would simply not be obvious from a reading of only the cited references. The wholesale and random replacement of elements without motivation or teaching is clearly improper under the law.

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In view of the foregoing arguments, it is believed that the rejections under 35 U.S.C. §103 are overcome.

Accordingly, the Appellants respectfully solicit reversal of the final rejections and allowance of claims 1-20.

Appellants waive oral hearing.

The required fee of $165.00 under 37 C.F.R. §1.17(f) is submitted herewith.

PTO is authorized to charge any additional fees incurred as a result of the filing hereof or credit any overpayment to our account #02-0900.

Respectfully submitted,

Mark E. Tetreault

Mark E. Tetreault, Esq.
Reg. No. 48,289

BARLOW, JOSEPHS & HOLMES, Ltd.
101 Dyer Street, 5th Floor
Providence, RI 02903
(401) 273-4446 (tel)
(401) 273-4447 (fax)
met@barjos.com

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APPENDIX

Claims on Appeal

1. A method of forming a high thermally conductive article, comprising the steps of:

providing a metallic base matrix of, by volume, between 30 and 60 percent;

providing a first thermally conductive filler, by volume, between 25 and 60 percent; the first thermally conductive filler having an aspect ratio of at least 10:1;

providing a second thermally conductive filler, by volume, between 10 and 25 percent; the second thermally conductive filler having an aspect ratio of less than 5:1; and

mixing the first thermally conductive filler, the second thermally conductive filler and the metallic base matrix so that the first thermally conductive filler and the second thermally conductive filler are evenly dispersed throughout the metallic base matrix to form an entirely uniform molding composition;

injection molding the uniform composition into a unitary monolithic thermally conductive article; the first thermally conductive filler and the second thermally conductive filler and the base matrix therein cooperating to reduce the number of thermal interface gaps in said monolithic thermally conductive article.

2. The method of Claim 1, wherein said base matrix is a Metal Injection Molding Material selected from the group consisting of aluminum, copper, brass, alumina and magnesium.

3. The method of Claim 1, wherein said first thermally conductive filler has particles that are substantially flake-shaped.

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4. The method of Claim 1, wherein said first thermally conductive filler has particles that are substantially rice-shaped.

5. The method of Claim 1, wherein said first thermally conductive filler has particles that are substantially strand-shaped.

6. The method of Claim 1, wherein said first thermally conductive filler has particles that are substantially whisker-shaped.

7. The method of Claim 1, wherein said first thermally conductive filler is a material selected from the group consisting of aluminum, alumina, copper, magnesium, brass and carbon.

8. The polymer composition of Claim 1, wherein said second thermally conductive filler material is boron nitride grains.

9. The molding composition of Claim 1, wherein said second thermally conductive filler has particles that are substantially grain shaped.

10. The molding composition of Claim 1, wherein said second thermally conductive filler is a material selected from the group consisting of aluminum, alumina, copper, magnesium, brass, boron nitride and carbon.

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11. A method of forming a high thermally conductive article, comprising the steps of:

providing a metallic base matrix of, by volume, between 30 and 60 percent;

providing a first thermally conductive filler, by volume, between 25 and 60 percent; the first thermally conductive filler having an aspect ratio of at least 10:1;

providing a second thermally conductive filler, by volume, between 10 and 25 percent; the second thermally conductive filler having an aspect ratio of less than 5:1; and

mixing the first thermally conductive filler, the second thermally conductive filler and the metallic base matrix so that the first thermally conductive filler and the second thermally conductive filler are evenly dispersed throughout the metallic base matrix to form an entirely uniform molding composition;

casting the uniform composition into a unitary monolithic thermally conductive article; the first thermally conductive filler and the second thermally conductive filler and the base matrix therein cooperating to reduce the number of thermal interface gaps in said monolithic thermally conductive article.

12. The method of Claim 11, wherein said base matrix is a Metal Injection Molding Material selected from the group consisting of aluminum, copper, brass, alumina and magnesium.

13. The method of Claim 11, wherein said first thermally conductive filler has particles that are substantially flake-shaped.

14. The method of Claim 11, wherein said first thermally conductive filler has particles that are substantially rice-shaped.

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15. The method of Claim 11, wherein said first thermally conductive filler has particles that are substantially strand-shaped.

16. The method of Claim 11, wherein said first thermally conductive filler has particles that are substantially whisker-shaped.

17. The method of Claim 11, wherein said first thermally conductive filler is a material selected from the group consisting of aluminum, alumina, copper, magnesium, brass and carbon.

18. The polymer composition of Claim 11, wherein said second thermally conductive filler material is boron nitride grains.

19. The molding composition of Claim 11, wherein said second thermally conductive filler has particles that are substantially grain shaped.

20. The molding composition of Claim 11, wherein said second thermally conductive filler is a material selected from the group consisting of aluminum, alumina, copper, magnesium, brass, boron nitride and carbon.